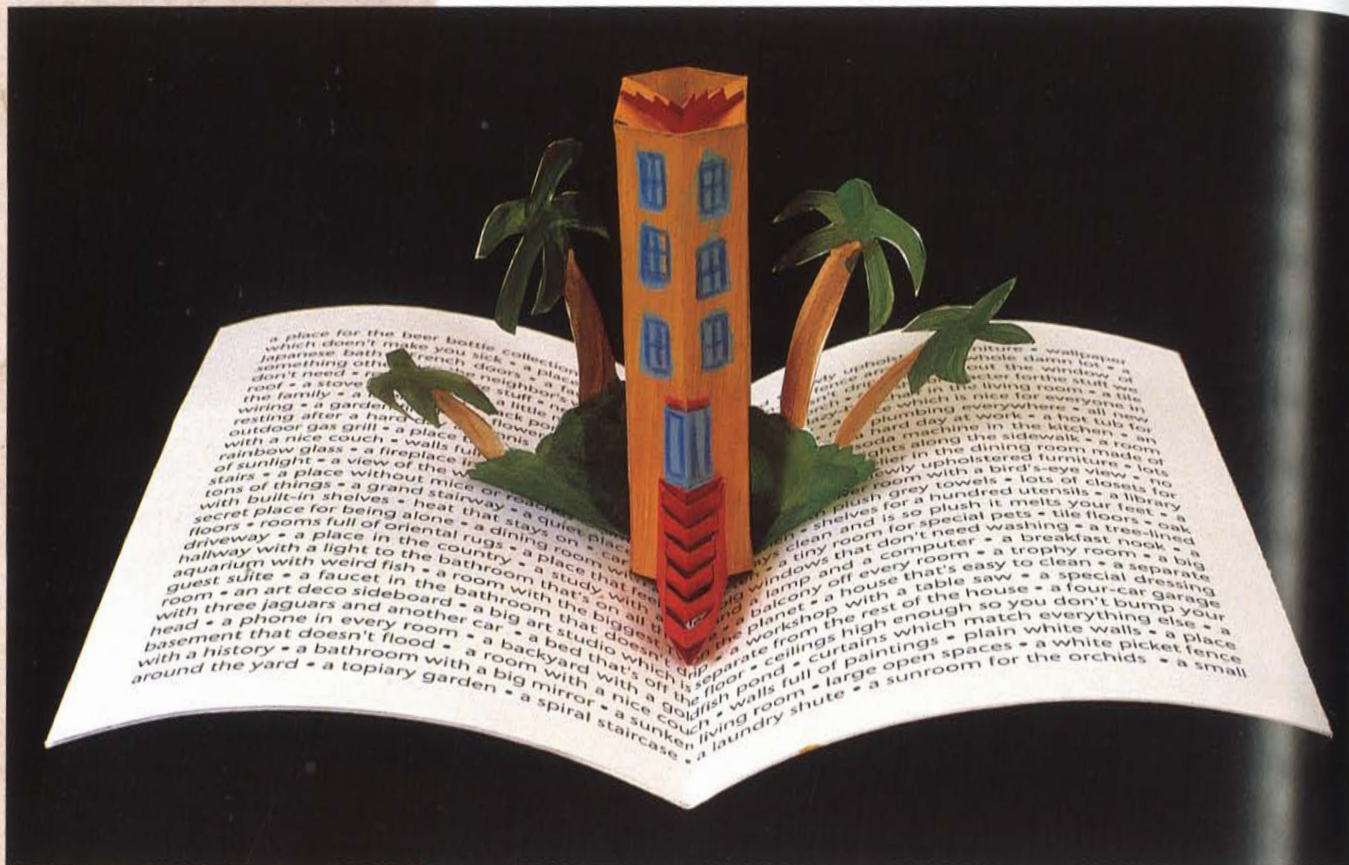


Engineering the Magic



Home Dreams,
1997 (also on
next page), 6 x 4
x 44 inches (15
x 10 x 110 cm).
Acrylic; laser-
print, accordion
book with hand-
cut pop-ups.
Photos by the artist.

There's magic in a book that pops up! What's more, delight at this magic is not limited to the young reader. I have known serious, hardened academics to suddenly shed all traces of scholarly gravity as they gleefully recall a favorite childhood pop-up storybook. For the child, the magic is simply in seeing a dimensional form arise from the flat page. For the adult, there's the same initial surprise, but added to that is the mystery of how the piece actually works. Many are content to know that there are people in this world who have figured it out. But for others, solving the mystery is the real source of pleasure in the pop-up form.

A pop-up is not just a static paper sculpture. It moves with the turning of the page. In essence, the page is a mechanical lever and the pop-up is a little paper machine; it moves up to collapse within the closed book and drops down into its dimensional form when the page is opened. Designers of pop-ups thus

are aptly titled paper engineers. It was this active element—the kinetic/mechanical/structural aspect—that first attracted me to explore the pop-up structure.

I've always enjoyed building things. I grew up building houses out of cardboard kitchen appliance boxes and geared whirligigs out of Tinker Toys. My father was a diesel engine mechanic, and I loved to play in his shop full of hand tools and scrap materials. Later, when I was in art school at Washington University in St. Louis, I had a sophomore design class that concentrated on dimensional and mechanical structures. The professor, Fern Tiger, was new to the school and reputed to be a stern taskmaster. She was. I learned a lot in the class—how to use shop tools, work with new materials, and, most importantly, how to solve functional design problems. Although I was a painting major, a lot of the groundwork for my later career as a sculptural bookmaker grew from these experiences.

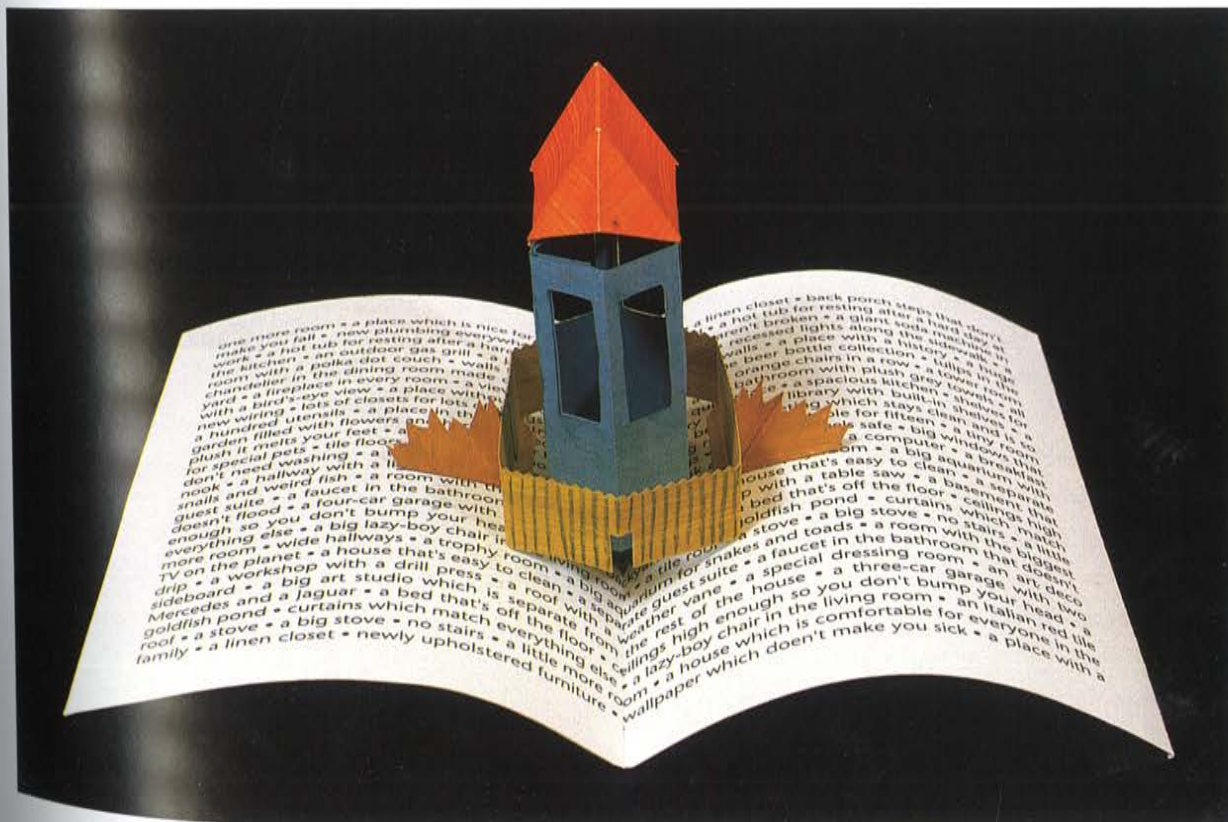
Oddly enough, I don't recall any pop-up books from my childhood. My first encounter with the "book as sculpture" was when a friend showed me her rummage sale find, an Italian carousel book tracing the tale of Sleeping Beauty through multi-layered pages. Each page was composed of three layers of scenery, much like a stage set, with the characters posed within the scene. What captured my imagination was the amazing dimensionality of the images, and the fact that they collapsed into the flat structure of the book when it was closed.

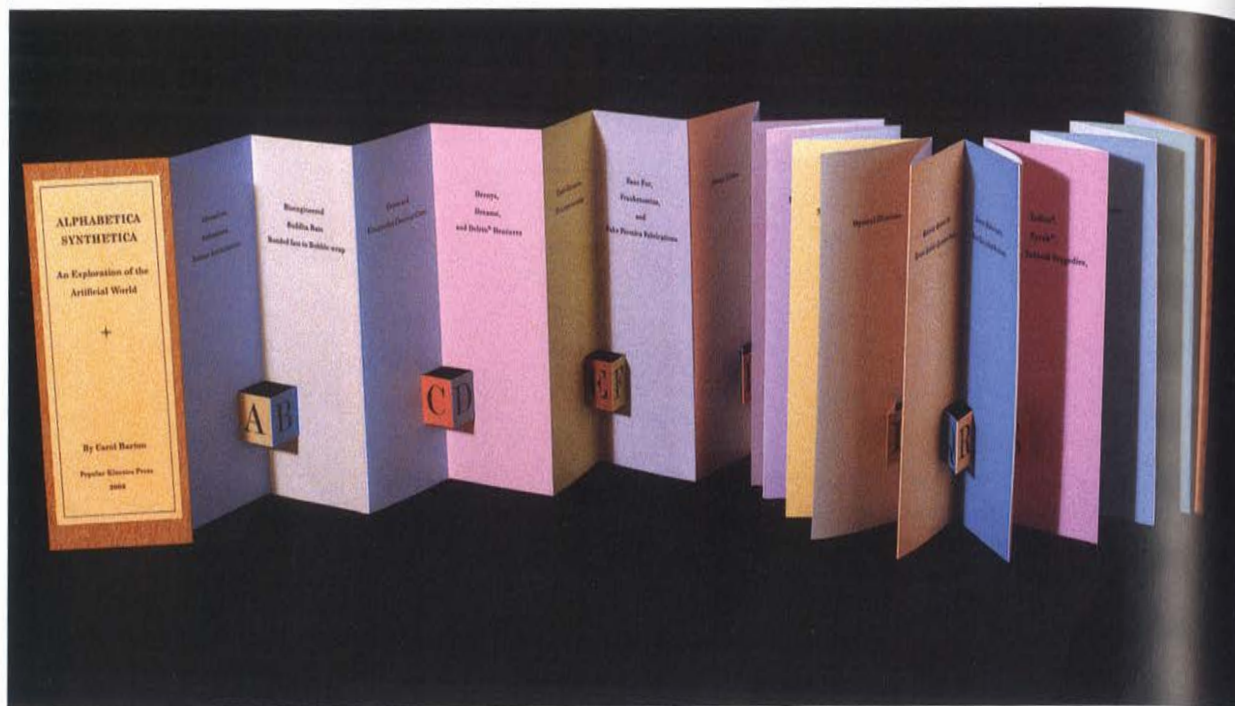
At this point I had already created my first artist's book in an edition of 250 copies. After spending a year on the project, I had returned to painting as a career—bookmaking was too time-consuming and difficult. But seeing the Italian book changed my mind. I began to view the book as a place where my separate creative interests in narrative painting, photography, sculpture, and functional design could converge. I think the book's potential for this creative synthesis is what appeals to many artists. Intrigued by the pop-up form, I was off on a new career path.

Graduated and living in Washington, D.C., my paper engineering tutelage began in some of my

favorite local hangouts: rare book libraries and museums. Lining the shelves of the Library of Congress, the Smithsonian Institution's Dibner Library, and the National Library of Medicine were troves of early movable and pop-up books that served as my guides. I learned that the earliest mechanical books, or "movables," dated back to the 14th century. In these, the viewer actively had to participate by turning a wheel or pulling a tab to activate the page. To my surprise, these early books were not meant for children, but were serious scientific treatises on such topics as astronomy, geometry, and human anatomy.

The true pop-up book did not appear until the early 19th century. Here the viewer simply turns the page and the pop-up springs up in all its dimensional brilliance. Most of these early pop-ups were produced for a young audience, but they undoubtedly delighted adults, too, and were avidly collected. By carefully examining how the pop-ups in such books were constructed (and sometimes peeking behind the pages to see the "guts" of the mechanisms), I began categorizing the various paper structures that would later serve me in my own work. Two of these structures, the V-fold and the asymmetrical pop-up, will be shown in





Alphabetic Synthetic,
2003. 7½ x 2½ x 70
inches (19 x 6.4 x
177.8 cm). Ink jet
printing. Photo by the artist.

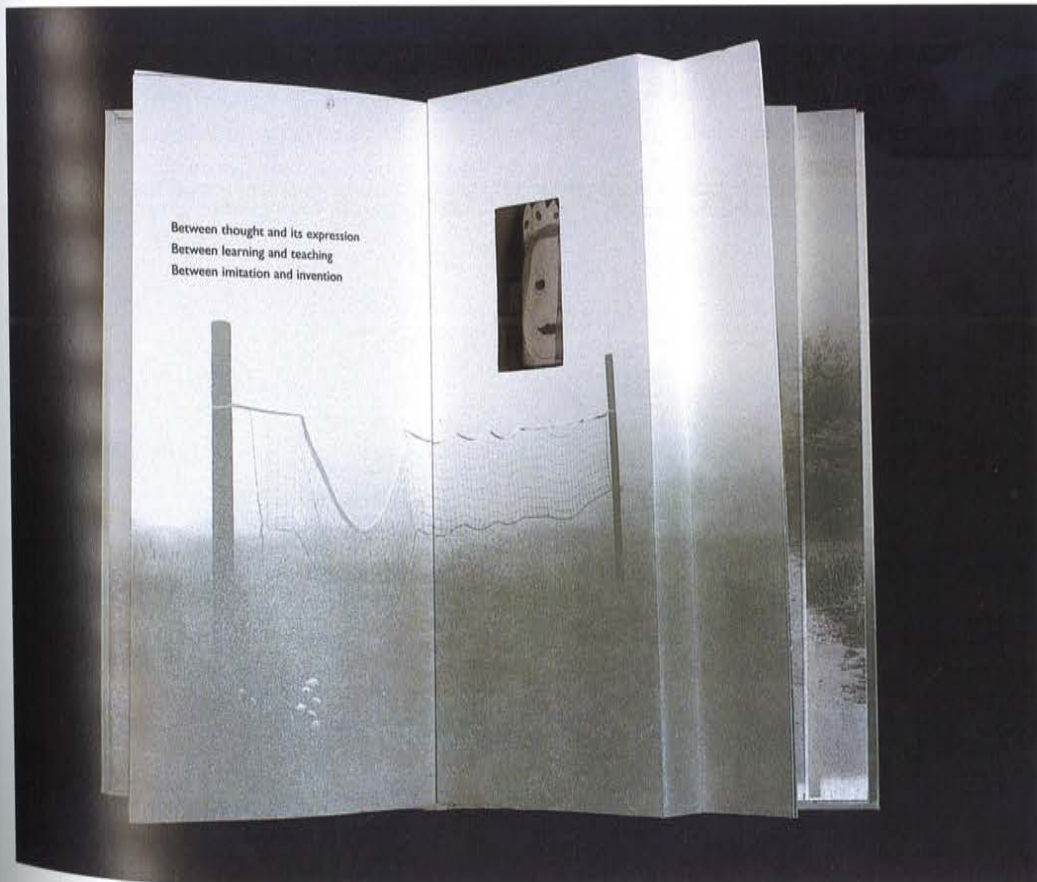
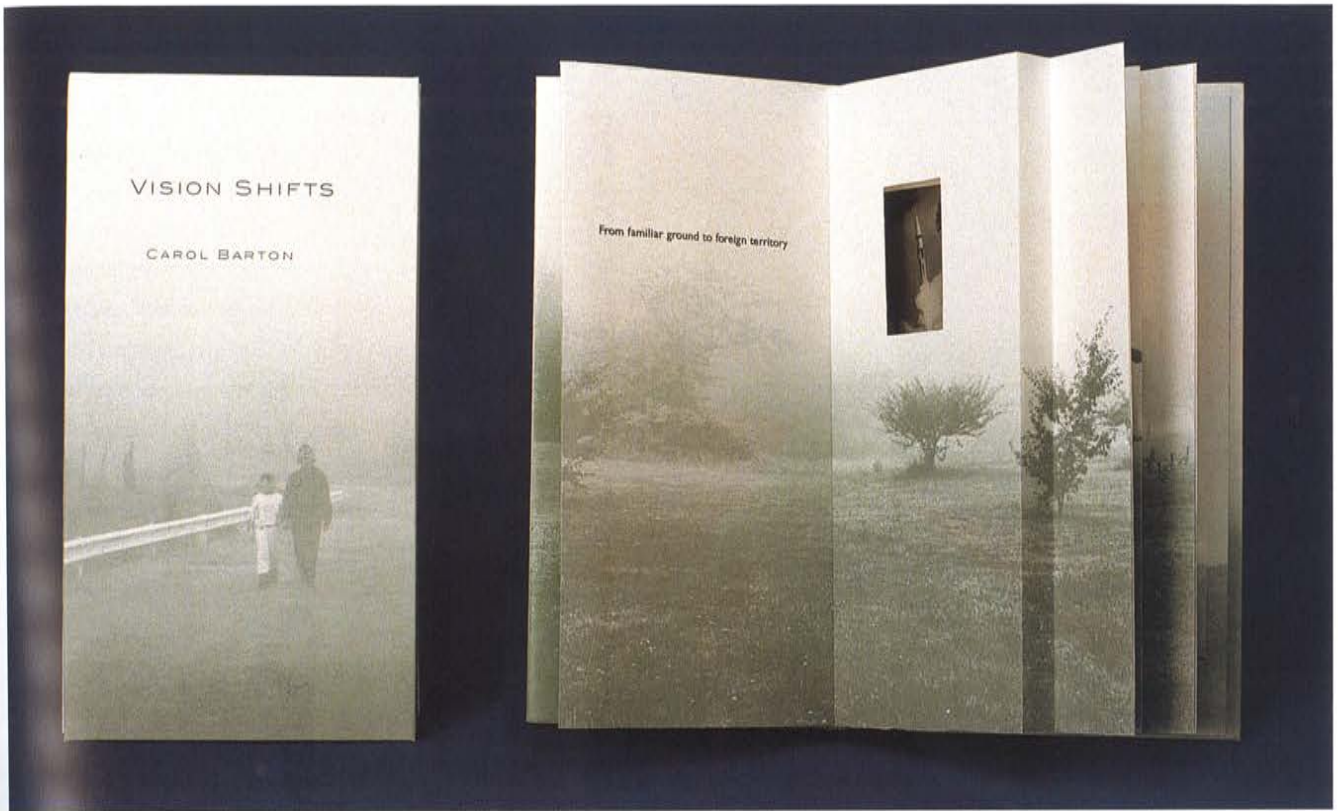
the Hands On section. Both of these structures are very strong and can be adapted to a variety of visual images. They can be used independently, or combined to create a more complex pop-up scene with lots of dimensional levels.

As with any art form, a technique alone does not define a successful piece. Once I understood the basic pop-up structures, the real challenge was to combine visual themes with the architecture of the page. In the commercial world, the paper engineer and the illustrator often are two very different people, each with her own creative language and skill. For me, my narrative painting and photography interests sided with the illustrator while the sculptor and mechanic sided with the engineer. The engineer approaches a project from a structural viewpoint, realizing the physical limits of what is and is not possible when mechanizing paper. The illustrator can envision the subject, the theme, but may not understand the physical limitations of the moving paper form. A minor tug-of-war can result, with the physics usually winning out over the imagery. It's much easier when both mindsets exist in one head, but even then it's hard to envision the two simultaneously.

So where do I start, with the image or the engineering? Each project is different. Sometimes I have an idea for a great theme, but it takes months, even

years, for the physical aspects of the project to evolve. My latest book, *Alphabetic Synthetic*, grew from an alphabetical list of synthetic materials I've been maintaining for more than three years. But it was only recently that I finalized the pop-up block structure for the letters and the color scheme that is integral to the finished design (see above photo). At other points I may accidentally discover an interesting twist on a pop-up structure or sculptural binding, and then I search for just the right idea to fit the form. This was the case with *Vision Shifts* (see photos on page 73), which began with my accidental discovery that a window floating in a pop-up panel moves or shifts position as the page is opened, thus panning over the picture behind the window. The entire book, with its theme of shifting points of view and how they change our view of the world around us, is based on this mechanical movement.

In either case, I work on each level of the thought process through a series of verbal and visual models and sketches. I may start with a list of brainstormed words or with a quick paper engineering test done with a scrap of paper. From there, the idea evolves through a set of increasingly complex mockups. By the end of the project I may have 30 or 40 of these mockups, several for each aspect of the project. I make models to test my visual sequences, models of



Vision Shifts, 1998. 9 x 4¼ inches (22.5 x 11.9 cm), closed. Mohawk superfine paper; offset lithography with die-cut sliding pop-up windows; edition of 500. *Photos by the artist.*

the book's binding, models and many more models of the pop-ups, and models of the text and the typography. So much for spontaneity! But if the project is successful, it often looks as if it sprang from a single, instantaneous flash of inspiration. And that's my goal, to marry form and function to the point where they appear perfectly logical, almost effortless, belying the multiple failures, mistakes, and false starts behind the finished piece.

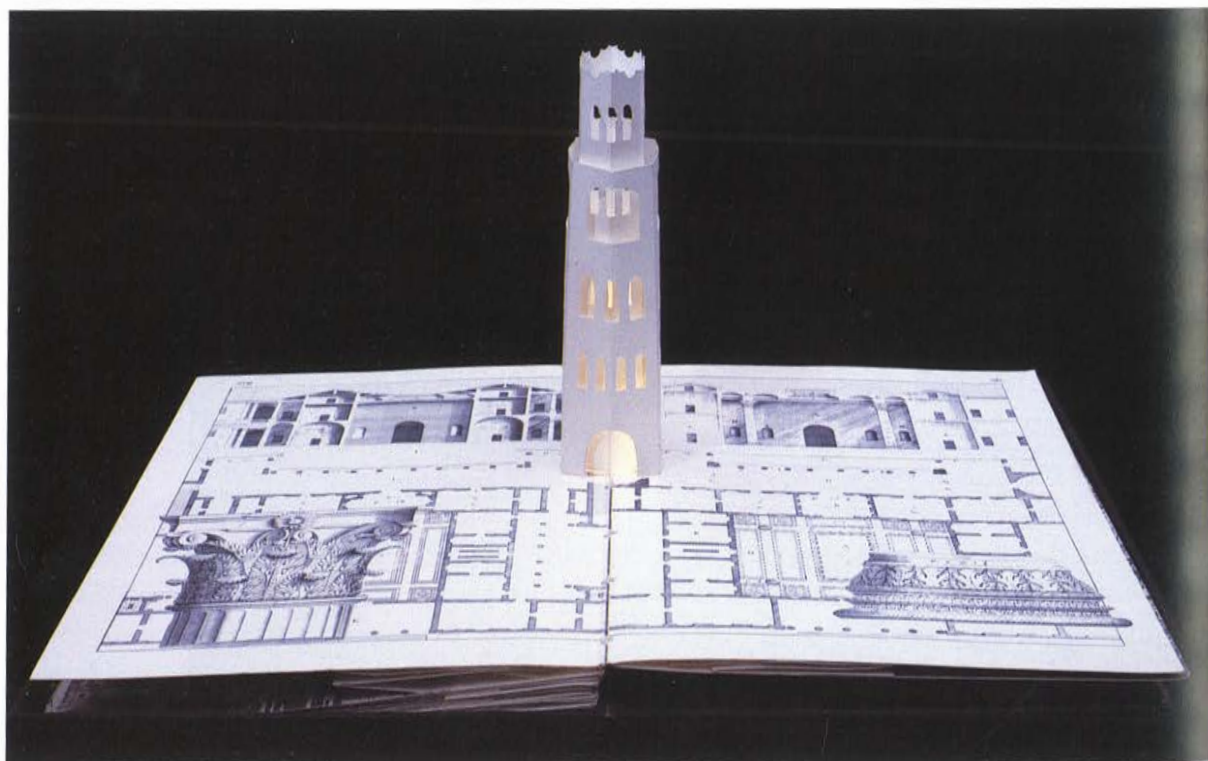
The pop-up elements of my books pose additional challenges. Aside from the actual engineering, there's the issue of the ideal position for each pop-up page and how this relates to the viewer. Various pop-up structures work best with the book viewed from different positions; some are viewed best with the book held upright, others with the book fully opened and flat on a table, still others with the page turned sideways at a 90° angle. Viewers usually are not aware of these differences, but if they are forced to continuously turn the book upside down and backwards to read it, they can be frustrated or, even worse, end up with a migraine. To prevent such disasters, I always try to create a pleasing rhythm in the sequencing of my pop-up pages. That's not to say that every page must be viewed from the same angle, but there should be an ease of flow to the turning of the page. Viewers

may remain unaware of these efforts to facilitate their visual comfort, but like most good design, successful innovations are often the least noticed because they seem so naturally logical.

Another consideration for me is the fact that I produce most of my artist's books in relatively large editions. Constructing pop-ups is labor intensive. Although the process of cutting them out has been mechanized, their assembly is still a hand process, even in the commercial world. Most commercial pop-up books are assembled in countries where labor costs are minimal, but I am my own assembly line and must think about the hours of time I'm willing to invest in putting my projects together.

I actually enjoy the assembly process. It's one in which my hands are busy, and my mind is free to wander and contemplate the next project or any number of intellectual challenges. In our modern, rush-rush society we have mechanized many of the traditionally repetitive daily tasks once required of our citizens, such as housecleaning and farm chores—usually to our gain. But I believe we need to retain some of this repetitive ritual to give rhythm to our lives and to relieve its stresses. I find my own meditative ritual in the repeated tasks of folding, cutting, and gluing required by my bookmaking. Additionally, I find the

Five Luminous Towers, 2002. (28.8 x 19.4 x 7.5 cm). Mohawk superfine paper, light bulbs, batteries, fiber optic filament; offset lithography on laser-cut pop ups; edition of 50. Photo by the artist.



job of streamlining production to be as creatively challenging as that of designing the original book. It's actually a process of redesign.

After the book has evolved through its many mockup stages to become an integrated piece, I rethink the entire project in terms of production. I tear the book apart and put it back together so that it requires the least amount of handwork possible, and then I invent the jigs and templates which speed up its manufacture even further.

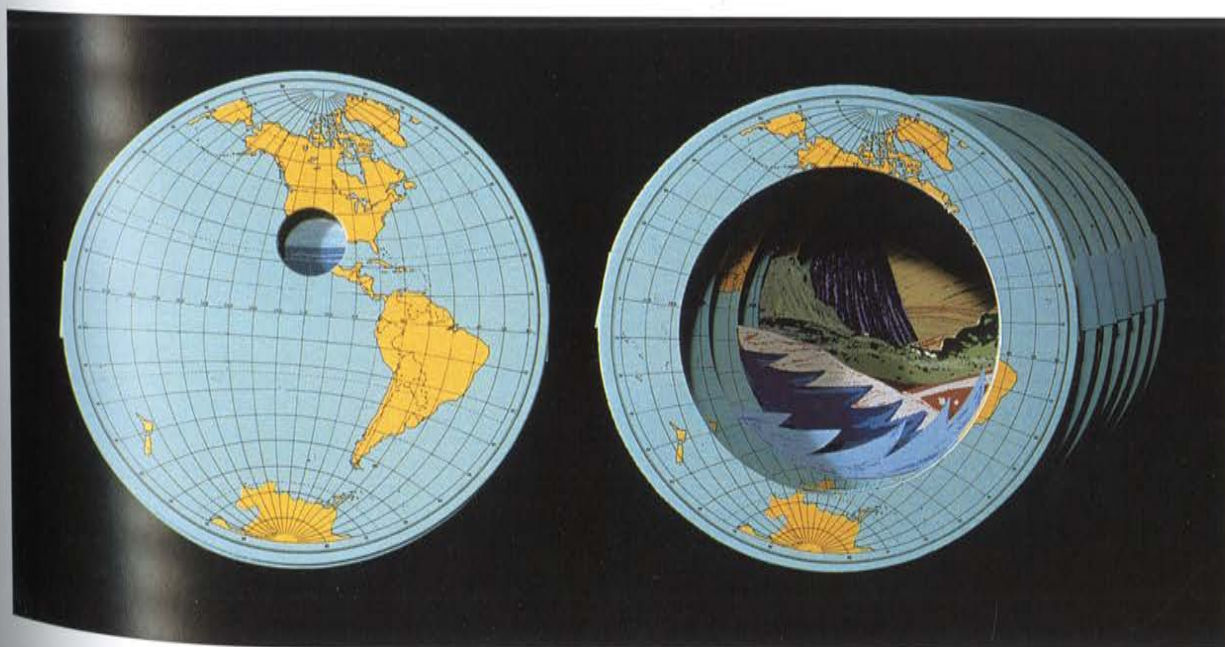
I make jigs for positioning cover images onto book boards, for scoring and folding pop-ups, for gluing parts together in the correct order and position, and for cutting tabs and trimming edges. I design dies and patterns for cutting out the pop-up parts, and incorporate into these the score lines and folds that facilitate their assembly and cut down on the time required.

This brings me to the subject of die cutting and laser cutting. As I mentioned before, the process of cutting pop-ups has been mechanized. Die cutting uses a press to cut out paper shapes and press in score



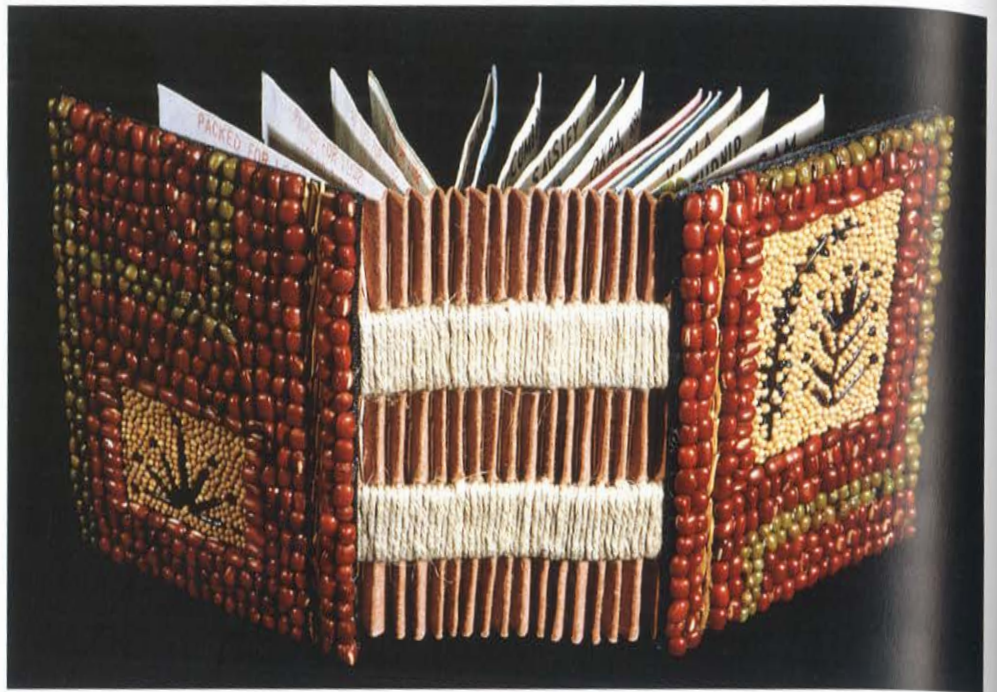
Loom, 1989. 5 x 7 x 9/4 inches (12.5 x 17.5 x 23.1 cm). Mohawk Superfine paper; offset lithography using press plates from graphite pencil drawings and photos; die-cut tunnel book; edition of 600. Photo by the artist.

lines for folds. Large die cutting shops use specially designed, self-feeding presses for this procedure, but I use a letterpress—the type of press that employs cast lead type for printing text. To use a letterpress for die cutting, I remove the inking rollers and wrap a flexible steel jacket around the press cylinder, or insert a zinc plate over the bed of a clamshell press to protect it from the cutting blades of the die. I send a drawing of the cutting and scoring pattern to a die-maker in New York City, and a few weeks later I receive in the mail my made-to-order die. It looks like a cookie-cutter set



Tunnel Map, 1988. 9/2 diameter x 10 inches (23.8 x 25 cm). Silkscreen; die-cut tunnel book; edition of 150. Photo by the artist.

Plant This Book, 1991. 5 x 3½ inches (12.5 x 8.8 cm). Mixed media, found seed packets; sewn binding on cords. Photo by the artist.

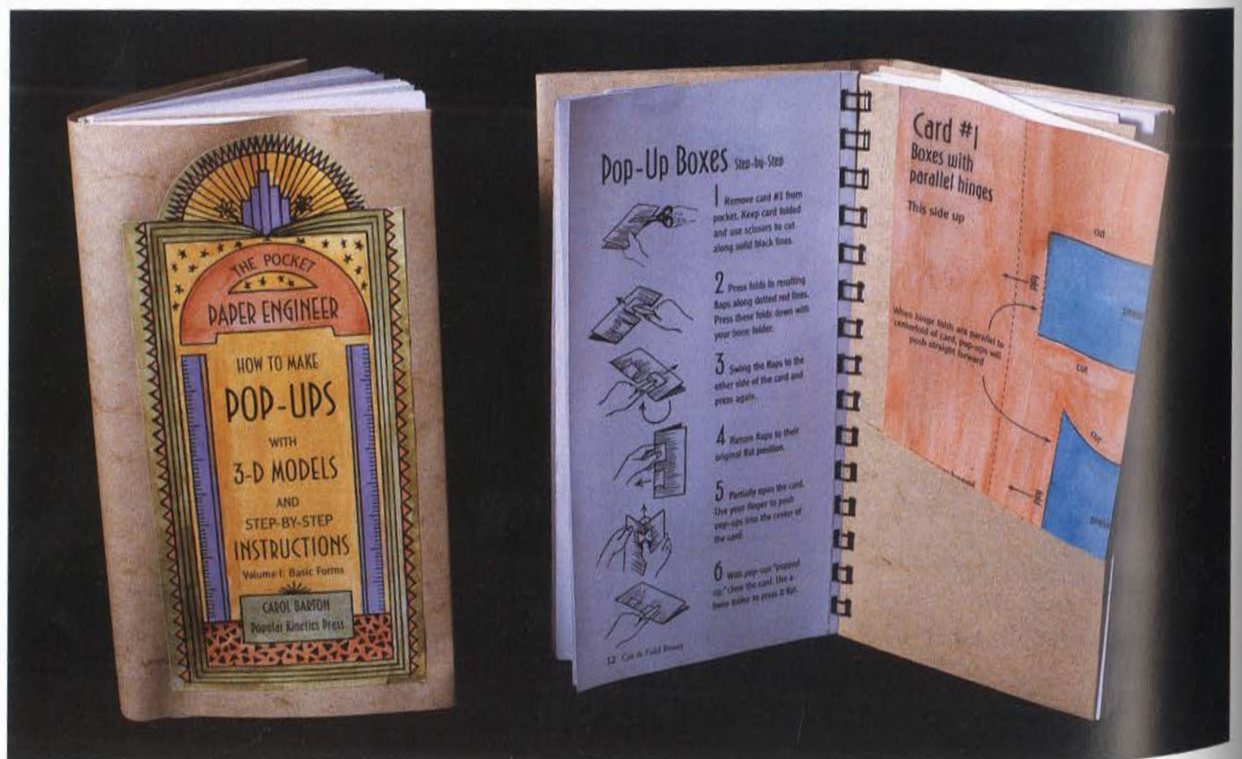


in plywood, with sharp blades for cutting and dull, rounded blades for scoring fold lines. I lock this die into my press in place of the lead type and hand feed the paper into the press. As the paper is pressed against the die, my pop-up parts are cut and scored.

A new technology for cutting very intricate pop-up parts uses a laser to literally burn through the paper. Laser cutting allows for an incredible amount of cut-

ting detail, but also requires access to what is currently an expensive piece of equipment. Moreover, cutting and scoring are two separate processes requiring different cutting depths. The pattern is taken directly from any vector-based computer drawing. I had my book *Five Luminous Towers* laser-cut because the small windows and details in the pop-up towers could not be die-cut. The results were astonishing. (See

The Pocket Paper Engineer, 2004. 4½ x 9½ inches (11.4 x 24 cm). An interactive how-to book with do-it-yourself pop-up models. Photo by the artist.



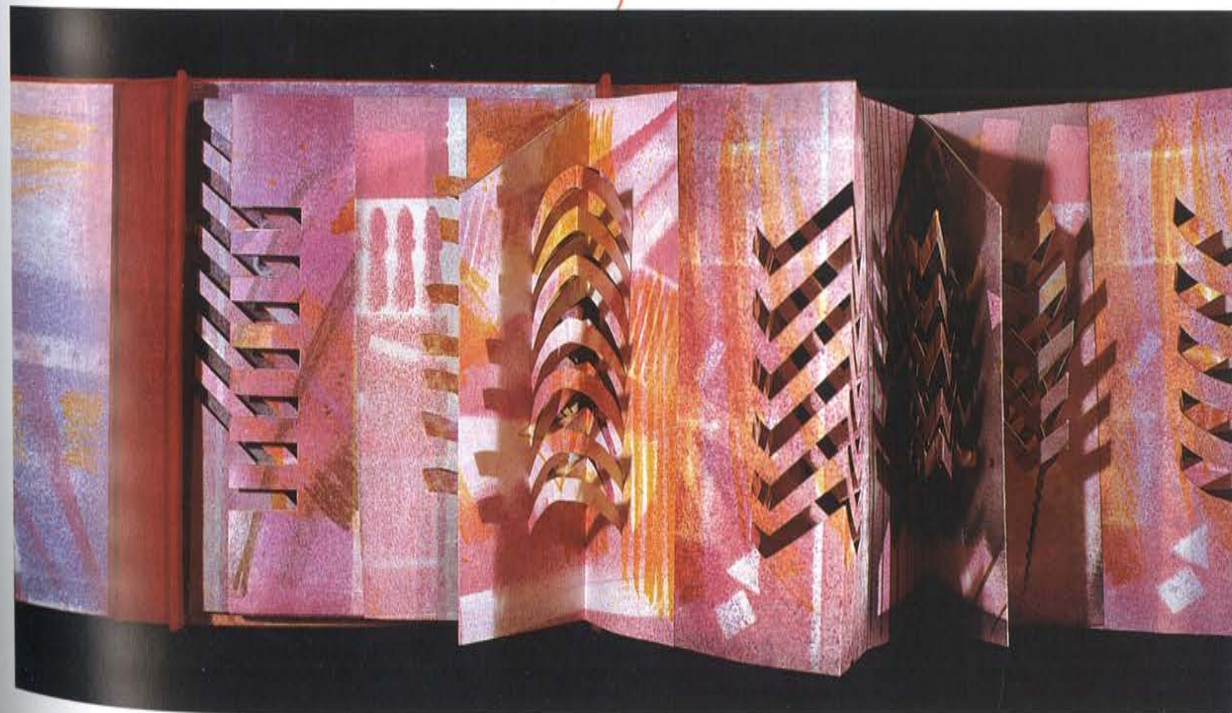
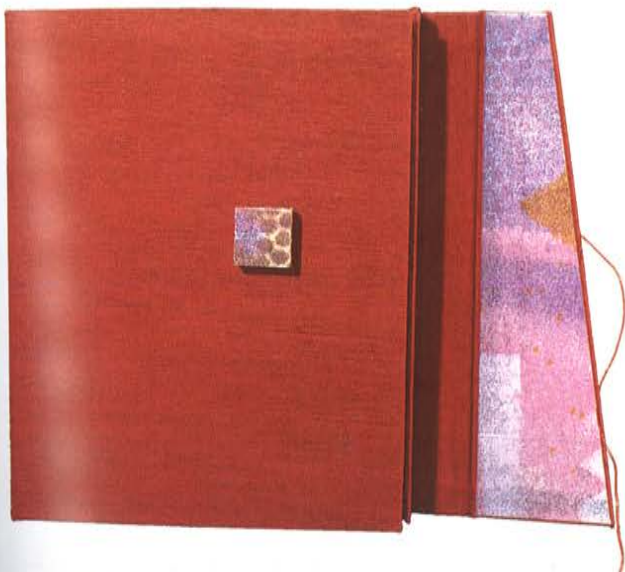
page 74.) My dream is that the technology will soon become so affordable that every artist will be able to own her own personal laser cutter!

Of course, if you are making just a single book or a small edition, you will probably choose to do the cutting and scoring by hand. Die and laser cutting require a monetary investment in addition to printing or computer skills, for limited editions, old-fashioned manual labor may be the best route. Two of the most important design elements, aside from aesthetics, are time and money, and design is a constant balancing act between them. If you have lots of one, often you have little of the other, and you must choose when

you want to spend your money to have someone else do the job, and when you want to devote your own time to the project out of necessity, love of the work, or a personal need for control. Skill and the need for precision also may dictate when a job is done manually and when it is best done mechanically.

Why use a pop-up structure? Every choice in a book project—typography, materials, sequencing, and construction—either enhances or detracts from its theme. The decision to use a pop-up in a book project should not be an arbitrary one. An idea should demand dimension. A pop-up can provide just the right element of surprise, focus, and clarity to your idea. It can introduce a sense of play to a work, or serve as a counterpoint to a serious subject.

Sometimes I regret that I have no childhood memories of a favorite pop-up text. But in many ways I'm probably fortunate that I didn't discover the pop-up form until I had already embarked on a career as an artist; I recognized the potential of engineered paper along with the surprise. The mystery has been solved. I can easily look at most pop-ups and recognize the tricks that make them move. The pop-up form pushes beyond the flatness of the page to break into the realm of sculpture. Yet it all folds down into a neat little package known as a book. Fortunately, the magic remains.



Rhythmic Notes on Seven Folds, 1990.
9 x 7½ x 58 inches
(22.5 x 18.8 x 145 cm), extended. Paper plates; hand-cut pop-ups; offset lithography; one-of-a-kind.
Photos by the artist.

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